

# Accessible Content Generation for the Learning Disabled

Zainab Pirani

Computer Department, MHSSCOE  
Mumbai, India

Sasikumar M.

Research & Development Department, CDAC  
Navi-Mumbai, India

**Abstract**—The research for this paper was conducted to explore the various aspects of Learning Disabled students and how the student-centered learning environments have been influenced and aided by educational technology. The educational content material which plays the important role in the field of educational technology has to be transformed in the way accessible to the LD learner. This paper provides the guidelines for the same as well provides the comparative analysis in support of the guidelines provided.

**Keywords**—Learning Disabled; Dyslexia; Educational Technology; Student Centered Learning Environment (SCLE); Content; Presentation Styles.

## I. INTRODUCTION TO LEARNING DISABILITY

Learning Disability (LD) is an umbrella term for various learning difficulties. Learning disabled students are not less intelligent or lazy, but their brain works differently. Because of this they see, perceive and act differently. As a result learning disabled people may take more time and effort, sometimes are even unable to perform skilful task which their counterparts can do without much effort. Learning Disability symptoms vary quite significantly from person to person; in fact no two individuals have the same Learning disability.

LD is not a disease and it cannot be cured. However, it is possible to help a LD child learn to cope with, and manage their, difficulties, and reach their potential at school and beyond.

### A. Some Common Signs of a LD Child[1]

- Make unexpected errors when reading aloud, miss words out or read the wrong word.
- Take ages to read something and understand it.
- Have difficulties with spelling.
- Have difficulties copying from the blackboard.
- Have slow and/or poor handwriting.
- Confuse, for example, 'b' and 'd', or '9' and '6'.
- Struggle to break words down into units of sound.
- Have difficulties with rhyming.
- Have difficulties learning a nursery rhyme/song.
- Spell the same word in a variety of ways.
- Excel at some things while having unexpected difficulties with others.
- Have difficulties learning times tables, days of the week or months of the year.
- Struggle to learn to tell the time.
- Find it difficult to remember a series of numbers, such as a telephone number.
- Find it difficult to remember a list of instructions.
- Confuse left and right.

- Appear to have miss-heard what you have asked him/her.
- Have similar difficulties to one or more blood-relatives.

Some of these signs though can be found in all learners at certain stages of their learning development adding to the difficulties in relatives to LD. Thus, depending upon the nature of the disability and the person, the noticeable symptom may vary.

This paper is organized as follows: Educational Technology covered in Section 2. The proposed guideline to generate accessible content for LD student is discussed in Section 3. Section 4 concludes the paper.

## II. EDUCATIONAL TECHNOLOGY

Educational technology has a profound effect on creating a student-centered learning environment (SCLE). These environments focus on the needs of the students while addressing their unique and individual learning styles and interests. There are numerous areas in which educational technology has been used to improve and meet the unique needs for the students [2]. The seven major areas in which educational technology has influenced student-centered learning environments; (a) software, (b) internet, (c) assistive technology, (d) problem-solving, (e) authentic learning, (f) collaboration, and (g) independence and uniqueness. Computer software can guide a student's learning at a pace which is suited to their own level and speed. The internet has an abundance of resources and information which can be tailored to benefit each student. Assistive technology can help special-needs students accomplish tasks previously never imagined. Problem-solving can easily be explored through technology while truly authentic learning experiences can become a reality. With technology as a part of the learning environment, collaboration can more easily play a critical role in learning, and allowing for student's independence and intellectual uniqueness can shine [3].

### A. SCLE and LD

Technology in SCLE's has also helped students that often have been over-looked; there is a plethora of assistive technologies available to improve learning but not specifically for the LD students. Because LD students have wide range of learning needs. They have their own unique set of strengths, weaknesses, interests, experiences and special abilities. Also every LD learner has its own unique learning style. So in order to improve the learning curve, the focus of SCLE should be on the actual content, the teaching strategies adapted for the content and the presentation styles for that content itself. The research in this field is still in progress[4].

To cater the above needs of LD students, a framework called ASLEN (Assistive Learning Environment) was designed to provide assistance to them to overcome the educational barrier by providing multiple pathways for alternate content presentation and pedagogical methods and strategies to enhance their learning experience [5]. This paper provides guidelines on the presentational styles for the content that are easily adapted by the LD students.

### III. GUIDELINES FOR GENERATING ACCESSIBLE CONTENT FOR LD STUDENTS

Content plays a very important role in educational technology. The degree of complexity increases when the content has to be accessed by the LD students. The available content is totally in the inaccessible format, it has to be transformed into the format which can be accessible for the LD students [6].

#### A. Steps to provide Accessible Content to the LD students

Figure 1 illustrates the steps to provide accessible content to the LD students. The aim is to transform the existing content which can help in building appropriate presentational interventions for LD which is explained as follows:

1) *Selection of the existing content:* Currently the content used in SCLE are designed in various formats but are not meant specifically for LD. So in this first step, the existing content will be extracted from the content repository and will be checked for the adaptability factor. This factor provides us with the ratio that decides whether the content will be able to adapt it self in different forms according to LD learner.

2) *Content Transformation Guidelines:* Based on the adaptability factor, the content will be incorporated with text, graphics, audio, video according to the learning requirement of the LD learners which is available in their Individualized Education Program (IEP). The following points are considered in the process of the content transformation and is explained as follows:

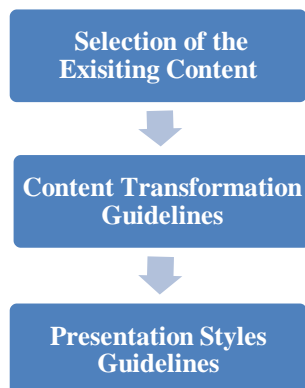


Figure 1. Steps to Provide Accessible Content to the LD Students.

- The content to be taught should be broken up into manageable chunks, e.g. chapter broken into various topics
- The words used in text should be according to the vocabulary of the LD student.
- The language used in the content can be formal or informal depending upon the learner's age. For e.g. if

age of the LD learner is less than seven then the language used for the explanation will be informal whereas age above seven years the language can be formal.

- The content must be taught using various images, videos and audios depending upon the learning styles of the LD students.
- The content must be in short sentences that makes reading task easy and more lucid.
- There should be sufficient space between the text and page layout should have enough margins. This makes text more readable and encourages good reading flow and speed along with understand ability.

Based on the above guidelines, the existing content is transformed according to the LD student requirements.

3) *Presentation Styles Guidelines:* The final step to get the accessible content for the LD learner is to represent the transformed content in such a format that the LD learner be very comfortable with it and can understand what exactly is taught to them. The presentation styles are divided into following two categories:

a) *General Presentation Styles:* Following points are considered for general category:

- The content should be printed in clear font that is easy to read.
- The letters of text content should be easily distinguishable.
- The size of the font should be clear enough neither too big nor too small.
- The line heights between two lines should be flexible according to the LD learner's requirement.
- Different colors should be used for text representation such as start of main topic should have a unique color, sub-topic should have unique color
- Different background color must be used for the textbook e.g. Light color must be used as a background instead of white background.

b) *Learner Specific Presentation Styles:* Following points are considered for learner specific problem category:

- Confusing alphabet such as b, d, m, w etc must have different font size so that it can be distinguishable.
- Miss out lines while reading must be provided with the grid lines.
- Difficulty in understanding the words must be provided with the access of dictionary dealing with text, images and videos.
- Finds it hard to read adjacent alphabet in a word must be presented with alphabet spacing.
- Transpose words e.g left-->felt must be accommodate with word spacing
- Miss out lines while reading must be provided with horizontal line after every sentence.

After completion of the above step, the content is in the format that is acceptable by the LD learner.

### B. Evaluation of Steps to provide Accessible Content

For the evaluation purpose, we visited two LD institutes and interacted with 15 LD students with various severity levels (0-1) of their learning problems. The age group interacted was between 10 – 15 years as shown in the figure 2.

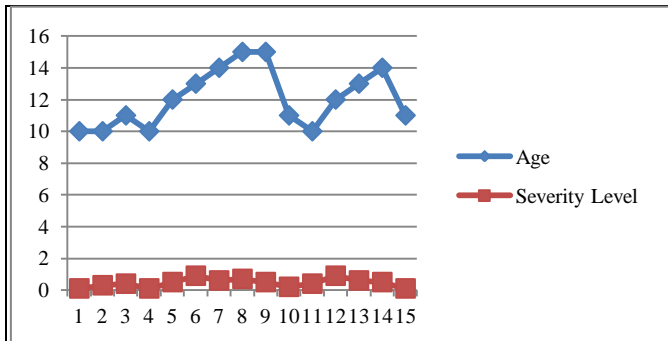


Figure 2. Ld Learner Information.

Now based on the severity level of their learning problems, a questionnaire based on the steps of generating accessible content was circulated among the learners and feedback was taken. These feedbacks were categorized as general presentation feedback and learner specific presentation feedback as explained above. Figure 3 & 4 provides information for the same.

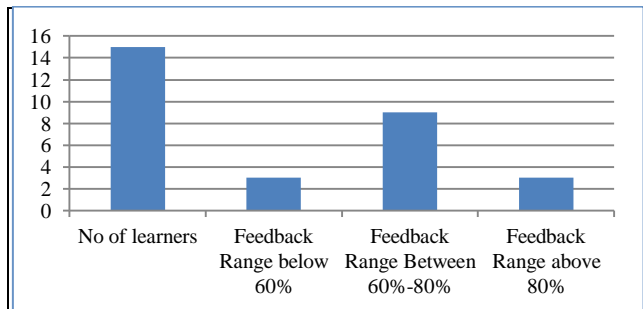


Figure 3. General Presentation Feedback.

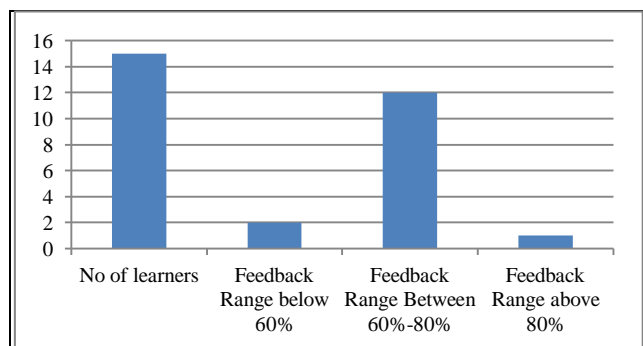


Figure 4. Learner Specific Presentation Feedback

Based on the feedback received from the LD students, a comparative analysis with what LD student require and what we predict for them is shown in the figure 5.

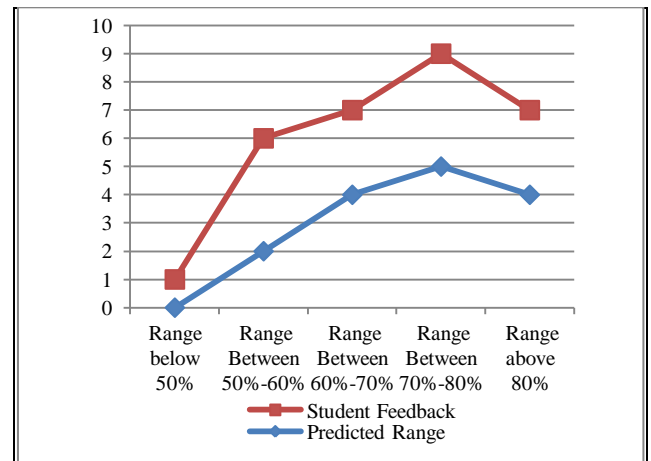


Figure 5. Comparative Analysis.

## IV. CONCLUSION.

The role of content in the field of educational technology is very critical. Our guidelines were provided to develop the accessible content for all types of LD learner. Then feedback was taken for those guidelines and a comparative analysis was done which proves that there was a close match on the guidance provided and actual requirement of the LD learner.

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